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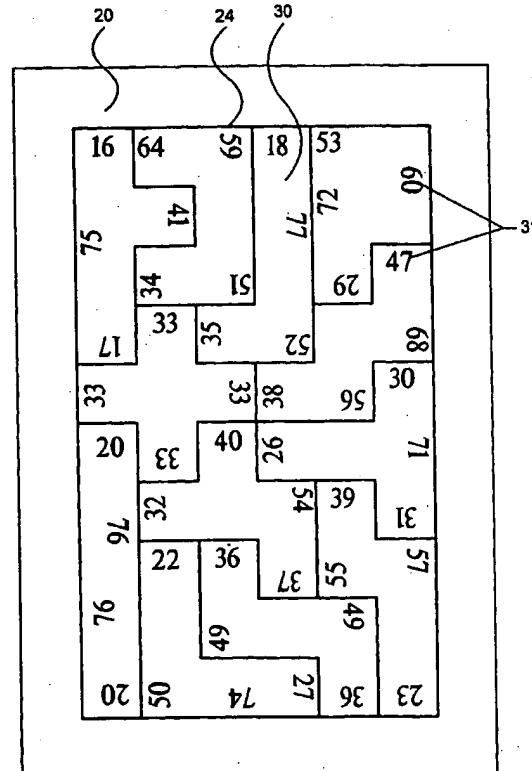
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(71) Applicant (for all designated States except US): MORIAS, Patricia, Jean, Henriette [NL/NL]; Balistraat 7, NL-5014 BG Tilburg (NL). (71) Applicant and (72) Inventor: VERHOEVEN, Gerardus, Adrianus, Maria [NL/NL]; Balistraat 7, NL-5014 BG Tilburg (NL).

[Continued on next page]

(54) Title: PENTOMINO PUZZLE GAME



(57) Abstract: A puzzle game comprises twelve mutually different pentomino pieces (30), each pentomino piece (30) being provided with marks (31). Further, the puzzle game comprises a holder (20) having a recess (23) for receiving the pentomino pieces (30), the recess (23) having a rectangular circumference (24). The marks (31) are provided for the purpose of recording of the configuration of the puzzle pieces (30) in the recess (23). Different pentomino pieces (30) are provided with different marks (31). Further, the marks (31) on one pentomino piece (30) have mutually different orientations which correspond to possible orientation of the pentomino piece (30) with respect to the circumference (24) of the recess (23). In this way, the marks (31) offer the possibility of describing each possible puzzle game solution by means of a unique code.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PENTOMINO PUZZLE GAME

The present invention relates to a puzzle piece, designed to be positioned with respect to a border having a predetermined shape with a defined upper side and under side. The present invention further relates to a puzzle game, comprising a plurality of puzzle pieces.

US 3 964 749 discloses a puzzle game which comprises a holder having a rectangular recess and eighteen puzzle pieces, wherein the puzzle pieces are shaped as so-called "pentominoes", which are defined as puzzle pieces which are theoretically constituted by five identical square elements, each square element having a full edge connection with at least one other square element. A player is supposed to fit all eighteen puzzle pieces in the recess, a receiving surface of which equals the surface of the eighteen puzzle pieces. Therefore, when the puzzle is completed, the entire receiving surface is covered by the puzzle pieces, wherein there is no space between the puzzle pieces. An interesting aspect of the puzzle game is the fact that there are many different ways in which the recess may be filled with the puzzle pieces. It is a challenge to many players to look for all possible solutions.

It is an object of the present invention to provide a puzzle piece which offers the possibility of easy identifying said puzzle piece as well as its orientation in a puzzle. This object is achieved in a puzzle piece according to Claim 1. This object is also achieved in a puzzle piece according to Claim 8.

In a similar sense, it is an object of the present invention to provide a puzzle game which offers the possibility of easy recording of the configuration of the puzzle pieces in a border having a predetermined shape. This object is achieved in a set of puzzle pieces according to Claim 6. This object is also achieved in a puzzle game according to Claim 17.

It is noted that in this context, the concept of "orientation" relates to a position of a puzzle piece with respect to a border having a predetermined shape, in a plane parallel to main surfaces of the puzzle piece, which normally has a substantially flat shape,

and applies to a front main surface as well as a rear main surface of the puzzle piece.

According to the present invention, the puzzle piece is provided with marks. The marks offer the possibility of easy recording of the exact configuration of a plurality of puzzle pieces with respect to a border, as each puzzle piece may be provided with unique marks and as each possible orientation of the puzzle pieces with respect to the border may be represented by the marks. In other words, the marks may represent a certain puzzle piece as well as the orientation of that certain puzzle piece. Therefore, all that a player needs to do to record a configuration, is to view the border in its upright orientation and record the marks which have an upright orientation, in a predetermined sequence, for example a sequence which can be found when reading from left to right and from 15 top to bottom.

The invention will now be explained in greater detail with reference to the non-restricting examples of embodiments shown in the figures, in which similar parts are indicated with the same 20 reference signs, and in which:

figure 1 is a plan view of a holder of a puzzle game according to the present invention;
figure 2 is a sectional view taken on the line A-A of figure 1;
figure 3 is a plan view of the holder as shown in figure 1, filled 25 up with puzzle pieces according to the present invention;
figure 4 is a plan view of a front surface and a rear surface of a first puzzle piece according to the present invention;
figure 5 is a plan view of a front surface and a rear surface of a second puzzle piece according to the present invention;
30 figure 6 is a plan view of a front surface and a rear surface of a third puzzle piece according to the present invention;
figure 7 is a plan view of a front surface and a rear surface of a fourth puzzle piece according to the present invention;
figure 8 is a plan view of a front surface and a rear surface of a 35 fifth puzzle piece according to the present invention;
figure 9 is a plan view of a front surface and a rear surface of a sixth puzzle piece according to the present invention;
figure 10 is a plan view of a front surface and a rear surface of a seventh puzzle piece according to the present invention;
40 figure 11 is a plan view of a front surface and a rear surface of a

eight puzzle piece according to the present invention;
figure 12 is a plan view of a front surface and a rear surface of a
ninth puzzle piece according to the present invention;
figure 13 is a plan view of a front surface and a rear surface of a
5 tenth puzzle piece according to the present invention;
figure 14 is a plan view of a front surface and a rear surface of a
eleventh puzzle piece according to the present invention;
figure 15 is a plan view of a front surface and a rear surface of a
twelfth puzzle piece according to the present invention; and
10 figure 16 is a plan view of a front surface and a rear surface of a
puzzle piece according to the present invention being provided with
alternative marks.

Figures 1 and 2 show a holder 20 for receiving and holding
15 puzzle pieces of a puzzle game according to the invention.

In the shown example, the holder 20 has a substantially flat
shape. A rear surface 21 of the holder 20 is substantially flat,
whereas a front surface 22 is provided with a recess 23 having a
rectangular circumference 24. The recess 23 comprises a supporting
20 surface 25 for supporting the puzzle pieces.

Preferably, the holder 20 is made of a plastic. The recess 23
may be applied by means of a milling process.

Suitable dimensions of the holder 20 and the recess 23 are as
follows:

25 - length of the holder 20 : 180.0 mm
- width of the holder 20 : 120.0 mm
- depth of the holder 20 : 6.0 mm
- length of the recess 23 : 150.5 mm
- width of the recess 23 : 90.5 mm
30 - depth of the recess 23 : 4.0 mm

Figure 3 shows an entire puzzle game according to the present
invention, comprising the holder 20 and twelve different puzzle
pieces 30. The shown puzzle pieces 30 are so-called pentomino
35 pieces, which are defined as puzzle pieces which are theoretically
constituted by five identical square elements, each square element
having a full edge connection with at least one other square
element. All possibilities for the shape of pentomino pieces are
represented by the twelve puzzle pieces 30, wherein in six pentomino
40 pieces two possibilities are united, as the shape of their front

surface is different from the shape of their rear surface.

In figure 3, the twelve puzzle pieces 30 are shown in a state in which they fill up the recess 23 of the holder 20, wherein the puzzle pieces 30 form a completed puzzle having a rectangular outer 5 circumference. This outer circumference corresponds to the circumference of the recess 23. In the completed puzzle, no space is present between the puzzle pieces 30, and the puzzle pieces 30 cover the entire supporting surface 25 of the recess 23.

It is a challenge to a player to find different ways for 10 filling up the recess 23. Some players may even try to find all possible configurations of the puzzle pieces 30, knowing that the total number of different configurations is 9,356. The present invention offers the possibility of recording the found solutions in a convenient way. For this purpose, the puzzle pieces 30 are 15 provided with marks 31.

In the shown example, each puzzle piece 30 is on both sides, i.e. on its front surface as well as on its rear surface, provided with a set of four marks 31, every mark 31 comprising a number. In order to enable identification of the puzzle pieces 30, every puzzle 20 piece 30 is provided with unique numbers, which do not occur on any of the other puzzle pieces 30.

An advantage of the utilization of numbers is that it is easy to define which side of the mark 31 is to be regarded as the upper side and which side of the mark 31 is to be regarded as the under 25 side, in other words, what the upright position of the numbers is. For most numbers, it is unambiguously clear what their upright position is. In cases in which two possibilities for the upright position of a number exist, for example in the case of the number 66, the upright position of the number may be determined by 30 underlining the number, wherein it is defined that the side at which the line is positioned is to be regarded as the under side of the number.

In this case, as the puzzle pieces 30 are constituted by 35 imaginary squares and the circumference 24 of the recess 23 has a rectangular shape, there are four different ways in which a puzzle piece 30 may be oriented with respect to this circumference 24, for both its front surface and its rear surface. In order to be able to represent each possible orientation, the four numbers on both main 40 surfaces of the puzzle piece 30 have different orientations, such that numbers which follow each other when following a circumference

of the puzzle piece 30 are rotated a quarter turn with respect to each other.

Further, in cases in which the main surfaces of a puzzle piece 30 have different shapes, so that the shape of the puzzle piece 5 changes when it is flipped over, the different sides of the puzzle piece 30 are provided with different sets of numbers.

The way in which the puzzle pieces 30 are marked and identified will be explained in more detail in the following description of the separate puzzle pieces 30.

10

In figures 4-15, the 12 different puzzle pieces 30 of the puzzle game are shown. For the sake of clarity of the following description of the puzzle pieces 30, the following arbitrary definitions are applied:

- 15 - the position of the puzzle piece 30 as shown in the figure is the upright position;
- the position of the puzzle piece 30 as shown at the left-hand side of the figure is the position in which the front surface is up, whereas the position of the puzzle piece 30 as shown at the right-20 hand side of the figure is the position in which the rear surface is up;
- the imaginary squares of the puzzle pieces 30 are counted from top to bottom and from left to right; and
- in the orientation as shown, the top of the puzzle piece 30 will 25 also be indicated North, the bottom of the puzzle piece 30 will also be indicated South, the left-hand side of the puzzle piece 30 will also be indicated West, and the right-hand side of the puzzle piece 30 will also be indicated East. The orientation as shown will also be referred to as North-up. The orientations obtained by clockwise 30 rotation over 90°, 180° and 270° will also be referred to as West-up, South-up and East-up, respectively.

Figure 4 shows a first puzzle piece 1, which is constituted by a vertical row of four imaginary squares of equal size and one 35 imaginary square which adjoins a right side of a second square of the row. The shape of a front surface F of the first puzzle piece 1 differs from the shape of a rear surface R of the first puzzle piece 1.

There are eight mutually different ways to place the first 40 puzzle piece 1 in a puzzle game solution. In other words, the first

puzzle piece 1 has eight different appearances. The concept of "appearance" relates to the number of ways in which a puzzle piece 30 can be fit in a recess having a certain shape. In this example, in which the puzzle pieces 30 are shaped as pentomino pieces, each 5 puzzle piece 30 can have eight different orientations: four with the front main surface up and four with the rear main surface up. In some of the puzzle pieces 30, two, four or even eight of these orientations can constitute the same appearance, meaning that there are two, four or eight different ways in which the puzzle piece 30 10 can be fit into the same recess. In other puzzle pieces 30, each orientation constitutes a different appearance. It will be understood that the number of appearances of a puzzle piece 30 relates to rotation symmetry the puzzle piece 30 may possess.

To identify the eight different appearances of the first puzzle piece 1, the front surface F and the rear surface R of the first puzzle piece 1 are provided with different sets of four different marks 31.

In this case, the front surface F is provided with numbers 16, 75, 17 and 41. In the North-up orientation of the first puzzle piece 20 1, the number 16 is in an upright position. In the West-up orientation of the first puzzle piece 1, the number 75 is in an upright position. This will also be indicated as "the number 75 is facing West". Similarly, the number 17 is facing South and the number 41 is facing East. Further, in this case, the rear surface R 25 is provided with numbers 15, 43, 21 and 70, wherein the number 15 is facing North, the number 43 is facing West, the number 21 is facing South and the number 70 is facing East.

Figure 5 shows a second puzzle piece 2, which is constituted by 30 a horizontal row of three imaginary squares of equal size, one imaginary square which adjoins a top side of a second square of the row and one imaginary square which adjoins a bottom side of a third square of the row. The shape of a front surface F of the second puzzle piece 2 differs from the shape of a rear surface R of the 35 second puzzle piece 2.

There are eight mutually different ways to place the second puzzle piece 2 in a puzzle game solution. To identify these eight different appearances, the front surface F and the rear surface R of the second puzzle piece 2 are provided with different sets of four 40 different marks 31.

In this case, the front surface F is provided with numbers 40, 32, 37 and 54, wherein the number 40 is facing North, the number 32 is facing West, the number 37 is facing South and the number 54 is facing East. Further, in this case, the rear surface R is provided 5 with numbers 42, 67, 46 and 24, wherein the number 42 is facing North, the number 67 is facing West, the number 46 is facing South and the number 24 is facing East.

Figure 6 shows a third puzzle piece 3, which is constituted by 10 a vertical row of four imaginary squares of equal size and one imaginary square which adjoins a left side of a fourth square of the row. The shape of a front surface F of the third puzzle piece 3 differs from the shape of a rear surface R of the third puzzle piece 3.

15 There are eight mutually different ways to place the third puzzle piece 3 in a puzzle game solution. To identify these eight different appearances, the front surface F and the rear surface R of the third puzzle piece 3 are provided with different sets of four different marks 31.

20 In this case, the front surface F is provided with numbers 18, 35, 52 and 77, wherein the number 18 is facing North, the number 35 is facing West, the number 52 is facing South and the number 77 is facing East. Further, in this case, the rear surface R is provided with numbers 19, 58, 66 and 44, wherein the number 19 is facing 25 North, the number 58 is facing West, the number 66 is facing South and the number 44 is facing East.

Figure 7 shows a fourth puzzle piece 4, which is constituted by 30 a horizontal row of three imaginary squares of equal size, one imaginary square which adjoins a top side of a first square of the row and one imaginary square which adjoins a bottom side of a third square of the row. The shape of a front surface F of the fourth puzzle piece 4 differs from the shape of a rear surface R of the fourth puzzle piece 4. On the other hand, the appearance of the 35 fourth puzzle piece 4 in the North-up orientation equals the appearance of the fourth puzzle piece 4 in the South-up orientation. As a consequence, there are four mutually different ways to place the fourth puzzle piece 4 in a puzzle game solution. To identify these four different appearances, the front surface F as well as the 40 rear surface R of the fourth puzzle piece 4 is provided with two

mutually different pairs of marks 31, wherein the pairs of marks 31 on the front surface F and the pairs of marks 31 on the rear surface R are mutually different as well.

In this case, the front surface F is provided with two numbers 5 36 and two numbers 49, wherein one number 36 is facing North, another number 36 is facing South, one number 49 is facing West and another number 49 is facing East. Further, in this case, the rear surface R is provided with two numbers 45 and two numbers 65, wherein one number 45 is facing North, another number 45 is facing 10 South, one number 65 is facing West and another number 65 is facing East.

Figure 8 shows a fifth puzzle piece 5, which is constituted by a vertical row of three imaginary squares of equal size and a 15 vertical row of two imaginary squares of equal size, wherein a second square of the row of two squares adjoins a left side of a first square of the row of three squares. The shape of a front surface F of the fifth puzzle piece 5 differs from the shape of a rear surface R of the fifth puzzle piece 5.

20 There are eight mutually different ways to place the fifth puzzle piece 5 in a puzzle game solution. To identify these eight different appearances, the front surface F and the rear surface R of the fifth puzzle piece 5 are provided with different sets of four different marks 31.

25 In this case, the front surface F is provided with numbers 39, 55, 23, 57, wherein the number 39 is facing North, the number 55 is facing West, the number 23 is facing South and the number 57 is facing East. Further, in this case, the rear surface R is provided with numbers 48, 73, 28 and 69, wherein the number 48 is facing 30 North, the number 73 is facing West, the number 28 is facing South and the number 69 is facing East.

Figure 9 shows a sixth puzzle piece 6, which is constituted by a horizontal row of three imaginary squares of equal size, one 35 imaginary square which adjoins a top side of a second square of the row and one imaginary square which adjoins a bottom side of the second square of the row. The shape of a front surface F of the sixth puzzle piece 6 equals the shape of a rear surface R of the sixth puzzle piece 6. Further, the appearances of the sixth puzzle piece 6 are the same for the North-up orientation, the West-up

orientation, the South-up orientation and the East-up orientation. As a consequence, there is only one way to place the sixth puzzle piece 6 in a puzzle game solution. Therefore, the sixth puzzle game 6 may be identified by only one mark 31. Although there is no need 5 for using both the front side f and the rear side r of the sixth puzzle piece 6 when looking for a solution, for the sake of convenience, it may be preferred to provide both the front side f and the rear side r of the sixth puzzle piece 6 with a mark 31. In the shown example, the front surface F and the rear surface R of the 10 sixth puzzle piece 6 are provided with equal sets of four equal marks 31, wherein the marks 31 of one set have mutually different orientations. In this case, the marks 31 comprise the number 33.

Figure 10 shows a seventh puzzle piece 7, which is constituted 15 by a vertical row of three imaginary squares of equal size, one imaginary square which adjoins a right side of a first square of the row and one imaginary square which adjoins a right side of a second square of the row. The shape of a front surface F of the seventh puzzle piece 7 differs from the shape of a rear surface R of the 20 seventh puzzle piece 7.

There are eight mutually different ways to place the seventh puzzle piece 7 in a puzzle game solution. To identify these eight different appearances, the front surface F and the rear surface R of the seventh puzzle piece 7 are provided with different sets of four 25 different marks 31.

In this case, the front surface F is provided with numbers 53, 72, 29 and 60, wherein the number 53 is facing North, the number 72 is facing West, the number 29 is facing South and the number 60 is facing East. Further, in this case, the rear surface R is provided 30 with numbers 63, 61, 25 and 62, wherein the number 63 is facing North, the number 61 is facing West, the number 25 is facing South and the number 62 is facing East.

Figure 11 shows an eighth puzzle piece 8, which is constituted 35 by a horizontal row of three imaginary squares of equal size, one imaginary square which adjoins a top side of a third square of the row and one imaginary square which adjoins a bottom side of the third square of the row. The shape of a front surface F of the eighth puzzle piece 8 equals the shape of a rear surface R of the 40 eighth puzzle piece 8. As a consequence, there are four mutually

different ways to place the eighth puzzle piece 8 in a puzzle game solution. To identify these four different appearances, the front surface F as well as the rear surface R of the eighth puzzle piece 8 is provided with four mutually different marks 31, wherein the marks 5 31 on the front surface F and the marks 31 on the rear surface R are the same.

In this case, the front surface F is provided with numbers 30, 26, 31 and 71, wherein the number 30 is facing North, the number 26 is facing West, the number 31 is facing South and the number 71 is 10 facing East. Further, in this case, the rear surface R is also provided with numbers 30, 26, 31 and 71, wherein the number 31 is facing North, the number 71 is facing West, the number 30 is facing South and the number 26 is facing East.

It will be understood that if the rear surface R of the eighth puzzle piece 8 is rotated over 180° with respect to the position in 15 which it is depicted in figure 11, the rear surface R equals the front surface F in every aspect. Therefore, in placing the eighth puzzle piece 8 in a puzzle game solution, it does not matter which one of the front side f and the rear side r is placed up.

20

Figure 12 shows an ninth puzzle piece 9, which is constituted by a vertical row of three imaginary squares of equal size, one imaginary square which adjoins a left side of a first square of the row and one imaginary square which adjoins a left side of a third 25 square of the row. The shape of a front surface F of the ninth puzzle piece 9 equals the shape of a rear surface R of the ninth puzzle piece 9. As a consequence, there are four mutually different ways to place the ninth puzzle piece 9 in a puzzle game solution. To identify these four different appearances, the front surface F as 30 well as the rear surface R of the ninth puzzle piece 9 is provided with four mutually different marks 31, wherein the marks 31 on the front surface F and the marks 31 on the rear surface R are the same.

In this case, the front surface F is provided with numbers 64, 34, 51 and 59, wherein the number 64 is facing North, the number 34 35 is facing West, the number 51 is facing South and the number 59 is facing East. Further, in this case, the rear surface R is also provided with numbers 64, 34, 51 and 59, wherein the number 51 is facing North, the number 59 is facing West, the number 64 is facing South and the number 34 is facing East.

40 It will be understood that if the rear surface R of the ninth

puzzle piece 9 is rotated over 180° with respect to the position in which it is depicted in figure 12, the rear surface R equals the front surface F in every aspect. Therefore, in placing the ninth puzzle piece 9 in a puzzle game solution, it does not matter which 5 one of the front side f and the rear side r is placed up.

Figure 13 shows an tenth puzzle piece 10, which is constituted by two horizontal rows of two imaginary squares of equal size, wherein a top side of a second square of a bottom row adjoins a 10 bottom side of a first square of a top row, and one imaginary square which adjoins a top side of a second square of the top row. The shape of a front surface F of the tenth puzzle piece 10 equals the shape of a rear surface R of the tenth puzzle piece 10. As a consequence, there are four mutually different ways to place the 15 tenth puzzle piece 10 in a puzzle game solution. To identify these four different appearances, the front surface F as well as the rear surface R of the tenth puzzle piece 10 is provided with four mutually different marks 31, wherein the marks 31 on the front surface F and the marks 31 on the rear surface R are the same.

20 In this case, the front surface F is provided with numbers 47, 38, 56 and 68, wherein the number 47 is facing North, the number 38 is facing West, the number 56 is facing South and the number 68 is facing East. Further, in this case, the rear surface R is also provided with numbers 47, 38, 56 and 68, wherein the number 38 is 25 facing North, the number 56 is facing West, the number 68 is facing South and the number 47 is facing East.

It will be understood that if the rear surface R of the tenth puzzle piece 10 is rotated over 90° in an anti-clockwise direction 30 with respect to the position in which it is depicted in figure 13, the rear surface R equals the front surface F in every aspect. Therefore, in placing the tenth puzzle piece 10 in a puzzle game solution, it does not matter which one of the front side f and the rear side r is placed up.

35 Figure 14 shows an eleventh puzzle piece 11, which is constituted by a horizontal row of three imaginary squares of equal size and a vertical row of two imaginary squares of equal size, wherein a second square of the vertical row adjoins a top side of a third square of the horizontal row. The shape of a front surface F 40 of the eleventh puzzle piece 11 equals the shape of a rear surface R

of the eleventh puzzle piece 11. As a consequence, there are four mutually different ways to place the eleventh puzzle piece 11 in a puzzle game solution. To identify these four different appearances, the front surface F as well as the rear surface R of the eleventh 5 puzzle piece 11 is provided with four mutually different marks 31, wherein the marks 31 on the front surface F and the marks 31 on the rear surface R are the same.

In this case, the front surface F is provided with numbers 27, 22, 50 and 74, wherein the number 27 is facing North, the number 22 10 is facing West, the number 50 is facing South and the number 74 is facing East. Further, in this case, the rear surface R is also provided with numbers 27, 22, 50 and 74, wherein the number 22 is facing North, the number 50 is facing West, the number 74 is facing South and the number 27 is facing East.

15 It will be understood that if the rear surface R of the eleventh puzzle piece 11 is rotated over 90° in an anti-clockwise direction with respect to the position in which it is depicted in figure 14, the rear surface R equals the front surface F in every aspect. Therefore, in placing the eleventh puzzle piece 11 in a 20 puzzle game solution, it does not matter which one of the front side f and the rear side r is placed up.

Figure 15 shows a twelfth puzzle piece 12, which is constituted by a horizontal row of five imaginary squares of equal size. The 25 shape of a front surface F of the twelfth puzzle piece 12 equals the shape of a rear surface R of the twelfth puzzle piece 12. Therefore, in placing the twelfth puzzle piece 12 in a puzzle game solution, it does not matter which one of the front side f and the rear side r is placed up. Further, the appearance of the twelfth puzzle piece 12 in 30 the North-up orientation equals the appearance of the twelfth puzzle piece 12 in the South-up orientation, and the appearance of the twelfth puzzle piece 12 in the West-up orientation equals the appearance of the twelfth puzzle piece 12 in the East-up orientation. As a consequence, there are two mutually different ways 35 to place the twelfth puzzle piece 12 in a puzzle game solution. To identify these two different appearances, the front surface F as well as the rear surface R of the twelfth puzzle piece 12 is provided with two mutually different pairs of marks 31, wherein the pairs of marks 31 on the front surface F and the pairs of marks 31 40 on the rear surface R are the same. Figure 15 clearly shows that the

shape of the twelfth puzzle piece 12 and the marks 31 are the same for the front surface F and the rear surface R.

In this case, the front surface F as well as the rear surface R is provided with two numbers 76 and two numbers 20, wherein one 5 number 76 is facing North, another number 76 is facing South, one number 20 is facing West and another number 20 is facing East.

An example of a configuration of the puzzle pieces 30 in the recess 23 of the holder 20 is shown in figure 3. The various numbers 10 on the puzzle pieces 30 offer the possibility of recording this configuration. This may be done by writing down the numbers which are in an upright position, following an imaginary route from left to right and from top to bottom of the recess 23. When it is assumed that in the upright position of figure 3, the upright position of the 15 recess 23 is shown, the configuration of the puzzle pieces 30 is laid down in the following code:

16 - 64 - 18 - 53 - 47 - 33 - 30 - 20 - 40 - 39 - 22 - 36.

There are other possibilities for the sequence in which the 20 numbers may be read, for example from top to bottom and from left to right of the recess 23. However, the possibility of going from left to right and from top to bottom is preferred, as this resembles the reading of a book.

Preferably, the numbers are positioned on the main surface of 25 the puzzle piece 30 such that each number is closest to the edge which constitutes the top edge when the puzzle piece 30 is in an orientation which corresponds to the orientation of the number.

It is noted that, if the completed puzzle as shown in figure 3 is rotated, a different coding for the solution appears. The 30 definition of the upper side and the under side of the recess 23 determines which coding is used for a certain solution, as this definition determines which numbers are recorded and the sequence in which the numbers are recorded.

In the example as shown, the recess 23 is mirror symmetrical. 35 Therefore, if the holder 20 is rotated over 180°, another solution can easily be found, without the need of changing the positions of the puzzle pieces 30, whereas in fact the completed puzzle is rotated 180° with respect to the recess 23.

The codes are not only helpful in finding all possible 40 configurations of the puzzle pieces 30 in the recess 23 of the holder 20; they also constitute a helpful communication means in

case two or more players wish to provide each other with solutions or to compare their solutions.

The minimum number of different marks 31 which is needed to

5 ensure identification of the orientation of the puzzle pieces 30, may be determined by performing the following steps:

- Determine the number of possible orientations of the puzzle piece 30 with respect to the border. In the shown example, this number is eight.
- 10 - Determine in how many different ways the puzzle piece 30 is rotation symmetrical. In the example of the fourth puzzle piece 4, the number of different ways is two, as the fourth puzzle piece 4 is one time rotation symmetrical at the front surface F as well as at the rear surface R. In the example of the twelfth puzzle piece 12, the number of different ways is four, as the twelfth puzzle piece 12 is two times rotation symmetrical at the front surface F as well as at the rear surface R. In the example of the sixth puzzle piece 6, the number of different ways is eight, as the sixth puzzle piece 6 is four times rotation symmetrical at the front surface F as well as 20 at the rear surface R.
- Divide the number of possible orientations by the number of different ways in which the puzzle piece 30 is rotation symmetrical. The resulting number indicates the number of appearances of the puzzle piece 30, and is the minimum number of different marks 31 which is needed to ensure identification of the orientation of the puzzle piece 30. In the example of the fourth puzzle piece 4, the resulting number is four, in the example of the twelfth puzzle piece 12, the resulting number is two, and in the example of the sixth puzzle piece 6, the resulting number is one.
- 30 All shown puzzle pieces 30 are provided with eight marks 31. The number of times that each mark 31 appears on the puzzle piece equals the number of different ways in which the puzzle piece 30 is rotation symmetrical.
- 35 As already mentioned in the foregoing, 9,356 possible different configurations of the puzzle pieces 30 exist. A player may try to find all these configurations in a systematic manner, by using a certain puzzle piece 30 in a certain orientation in a left upper corner of the recess 23 as a starting point, and looking for all 40 possible solutions which can be found when starting from this

starting point before choosing a new starting point. In the following table, a review is given of all possible starting points and the associated number of all possible solutions. Every starting point is denoted as a number, which corresponds to the number which 5 at that starting point constitutes the first number of the code of the solution:

| starting point | number of solutions | starting point | number of solutions | starting point | number of solutions |
|----------------|---------------------|----------------|---------------------|----------------|---------------------|
| 16 | 288 | 39 | 118 | 67 | 62 |
| 19 | 153 | 50 | 1,092 | 68 | 126 |
| 20 | 618 | 51 | 561 | 69 | 131 |
| 21 | 179 | 52 | 507 | 70 | 181 |
| 22 | 72 | 53 | 332 | 71 | 501 |
| 23 | 159 | 58 | 333 | 72 | 89 |
| 25 | 110 | 59 | 481 | 73 | 148 |
| 31 | 551 | 60 | 63 | 74 | 108 |
| 35 | 28 | 62 | 342 | 75 | 72 |
| 36 | 223 | 63 | 120 | 76 | 838 |
| 37 | 136 | 65 | 237 | 77 | 159 |
| 38 | 204 | 66 | 34 | TOTAL | 9,356 |

10 In a suitable embodiment of the puzzle pieces 30, the sides of the imaginary squares of which the puzzle pieces 30 are constituted, are 15.0 mm long. Further, in an advantageous embodiment, the thickness of the puzzle pieces 30 equals the depth of the recess 23 of the holder 20 by being 4.0 mm.

15 Preferably, the puzzle pieces 30 are made of a plastic. The puzzle pieces 30 may be manufactured by means of injection moulding, wherein the marks 31 may be formed as recesses with respect to the main surface of the puzzle pieces 30 during the injection moulding process. There are other ways of providing the puzzle pieces 30 with marks 31 formed as recesses with respect to the main surface of the 20 puzzle pieces 30, for example by means of milling or laser-beam techniques.

The marks 31 may also be applied by means of stickers on which 25 the marks 31 are printed, wherein the sticker preferably is suitable to cover an entire main surface of a puzzle piece 30. In case of a front surface F of a puzzle piece 30 having the same shape as a rear surface R of the puzzle piece 30, it is sufficient to cover only one

main surface with a sticker. All stickers of different puzzle pieces 30 may have the same colour, but it is for example also possible to have stickers with different colours for different puzzle pieces 30, or to assign one colour to stickers which are intended to cover the 5 front surfaces f of the puzzle pieces 30 and another colour to stickers which are intended to cover the rear surfaces r of the puzzle pieces 30.

In order to facilitate storing and transporting of the holder 20 and the puzzle pieces 30, the puzzle game may comprise a sleeve 10 (not shown) which is suitable to fit tightly around the holder 20, in order to prevent falling out of the puzzle pieces 30. Such a sleeve may be made of cardboard or another suitable material.

It will be clear to a person skilled in the art that the scope 15 of the present invention is not limited to the examples discussed in the foregoing, but that several amendments and modifications thereof are possible without deviating from the scope of the invention as defined in the attached claims.

The numbers on the puzzle pieces 30 as described in the 20 foregoing, are arbitrarily chosen and may be replaced by other numbers.

In the foregoing, marks 31 comprising numbers are shown. It will be understood that there are other possibilities, wherein it is 25 important that the orientation of the marks 31 may readily be determined. The marks 31 may for example comprise combinations of two small letters of the alphabet, or even constitute words, such that each solution constitutes a sentence. Also, the marks 31 may comprise pictures of animals or other recognizable pictures.

Figure 16 shows an example of symbols used as marks. Each 30 symbol has an upright orientation, which is defined by an arrow.

It is not an essential feature of the present invention that all puzzle pieces 30 of the puzzle game are provided with the same type of marks 31. It is even possible to provide one puzzle piece 30 with marks 31 of different types. In the puzzle game, for the sake 35 of identification the puzzle pieces 30, it is important that marks 31 which occur on a certain puzzle piece 30 do not occur on other puzzle pieces 30 having a different shape. Further, for the sake of determination of the orientation of a puzzle piece 30, it is important that the puzzle piece is provided with different marks 31 40 in different orientations, for each of the possible orientations of

the puzzle piece 30.

Preferably, a puzzle piece 30 comprises identical marks 31 for identical appearances of the puzzle piece 30.

5 In a symmetrical puzzle piece 30, the number of marks 31 may be reduced. For example, the sixth puzzle piece 6 as shown in figure 9 may be provided with only one mark 31. This one mark 31 may for example be positioned in the centre of the front surface F, and may comprise a symbol having the same symmetry as the sixth puzzle piece 6, for example a square or a circle.

10 It will be understood that within the scope of the invention, the number of puzzle pieces may be chosen to be different than 12, for example 18, the puzzle pieces do not need to be pentomino pieces, and the shape of the circumference of a completed puzzle may be chosen to be different than rectangular.

CLAIMS

1. Puzzle piece (30), designed to be positioned with respect to a border (24) having a predetermined shape with a defined upper side and under side, wherein the puzzle piece (30) has a predetermined number N of possible orientations with respect to the border (24),
5 the puzzle piece (30) having a shape symmetry S, indicating the number of ways in which the shape of the puzzle piece (30) is rotation symmetrical, such that, in said N possible orientations, the puzzle piece (30) has N/S different appearances; the puzzle piece (30) being provided with at least N/S mutually different marks
10 (31).
2. Puzzle piece (30) according to claim 1, being provided with N marks (31), wherein each mark (31) appears S times.
- 15 3. Puzzle piece (30) according to claim 1 or 2, wherein each mark (31) has a predetermined upper side, the marks (31) being arranged on the puzzle piece (30) such that their respective upper sides are directed in mutually different directions.
- 20 4. Puzzle piece (30) according to claim 3, the marks (31) being arranged such that, in each of the possible different appearances, only one of said marks (31) has its upper side directed upwards.
- 25 5. Puzzle piece (30) according to claim 4, wherein the position of the one mark (31) having its upper side directed upwards is closest to the upper edge of the puzzle piece (30).
- 30 6. Set of puzzle pieces (30) according to any of claims 1-5, wherein different puzzle pieces (30) are provided with different marks (31).
- 35 7. Set according to claim 6, comprising twelve mutually different puzzle pieces (30), the puzzle pieces (30) preferably being shaped as pentomino pieces, which are defined as puzzle pieces which are theoretically constituted by five identical square elements, each square element having a full edge connection with at least one other square element.

8. Puzzle piece (30), designed to be positioned with respect to a border (24) having a predetermined shape with a defined upper side and under side, wherein at least one main surface (F, R) of the
5 puzzle piece (30) is provided with at least two marks (31) having a defined upper side and under side, the marks (31) having different orientations which correspond to possible orientations of the puzzle piece (30) with respect to the border (24).

10 9. Puzzle piece (30) according to claim 8, being shaped as a pentomino piece, which is defined as a puzzle piece which is theoretically constituted by five identical square elements, each square element having a full edge connection with at least one other square element.

15 10. Puzzle piece (30) according to claim 8 or 9, wherein at least one main surface (F, R) is provided with four marks (31).

20 11. Puzzle piece (30) according to claim 10, wherein marks (31) which follow each other when following the circumference of the puzzle piece (30) are rotated a quarter turn with respect to each other.

25 12. Puzzle piece (30) according to any of claims 8-11, wherein at least two marks (31) on one main surface (F, R) of the puzzle piece (30) differ from each other.

30 13. Puzzle piece (30) according to any of claims 8-12, wherein at least one mark (31) comprises a number.

14. Puzzle piece (30) according to any of claims 8-13, wherein both main surfaces (F, R) are provided with at least two marks (31), preferably four marks (31).

35 15. Puzzle piece (30) according to claim 14, wherein the marks (31) on a front surface (F) differ from the marks (31) on a rear surface (R).

40 16. Puzzle piece (30) according to any of claims 8-15, wherein each mark (31) is positioned closest to the edge of the puzzle piece (30)

which constitutes the upper edge of the puzzle piece (30) when the mark (31) is in its upright orientation.

17. Puzzle game, comprising a plurality of puzzle pieces (30)
5 according to any of claims 8-16.

18. Puzzle game according to claim 17, wherein different puzzle pieces (30) are provided with different marks (31).

10 19. Puzzle game according to claim 17 or 18, further comprising a holder (20) having a recess (23) for receiving the puzzle pieces (30), wherein the shape of a circumference (24) of the recess (23) preferably corresponds to the predetermined shape of the border.

15 20. Puzzle game according to any of claims 17-19, wherein the border has a rectangular shape.

21. Puzzle game according to any of claims 17-20, comprising twelve mutually different pentomino pieces.

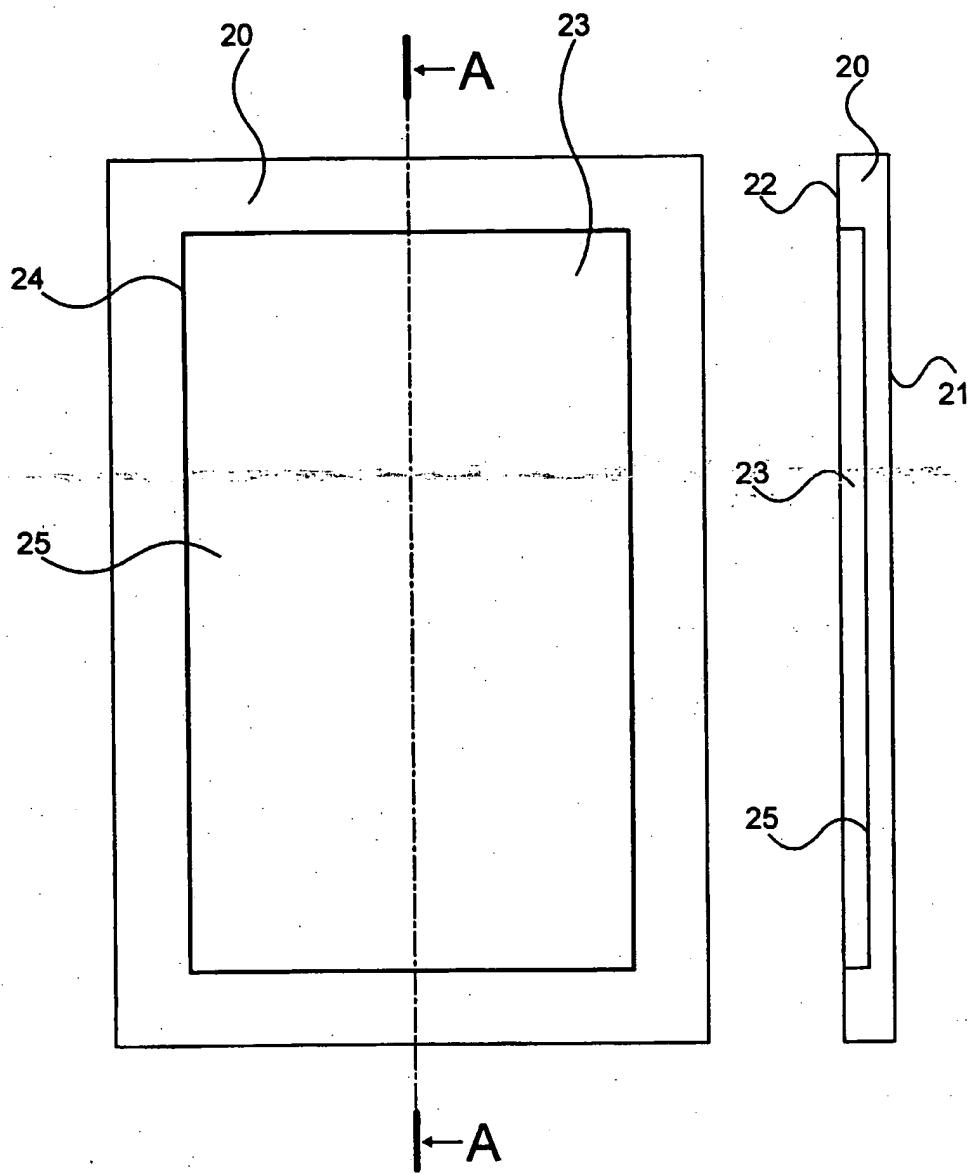


Fig. 1

Fig. 2

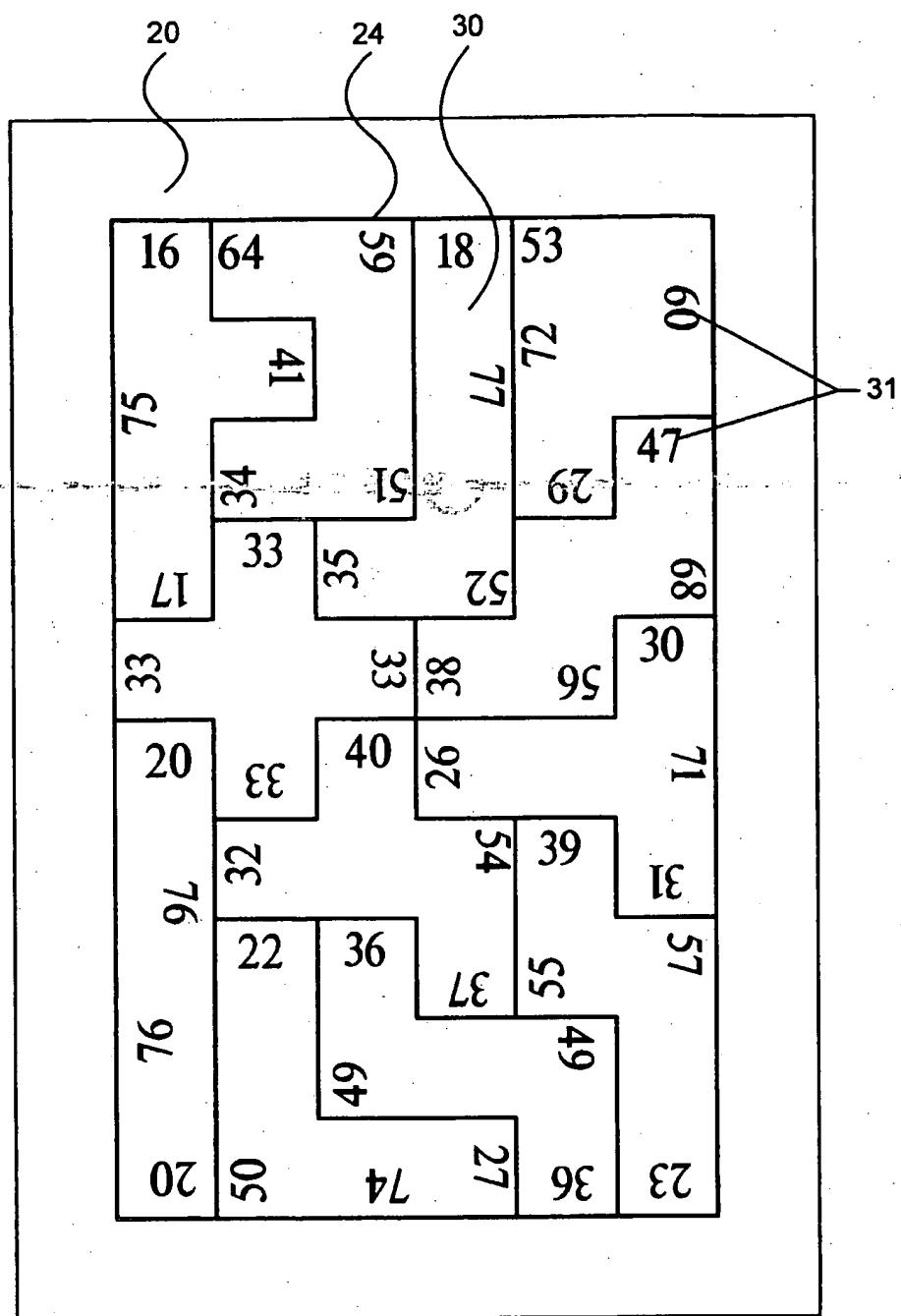


Fig. 3

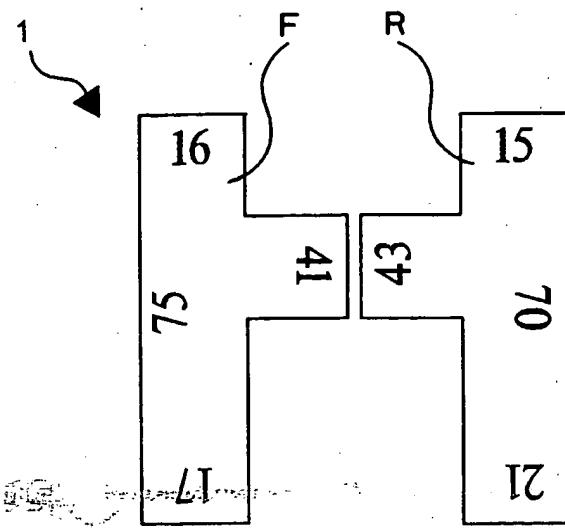


Fig. 4

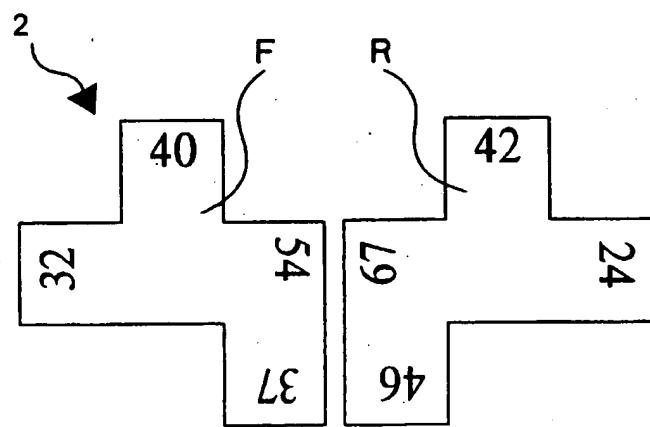


Fig. 5

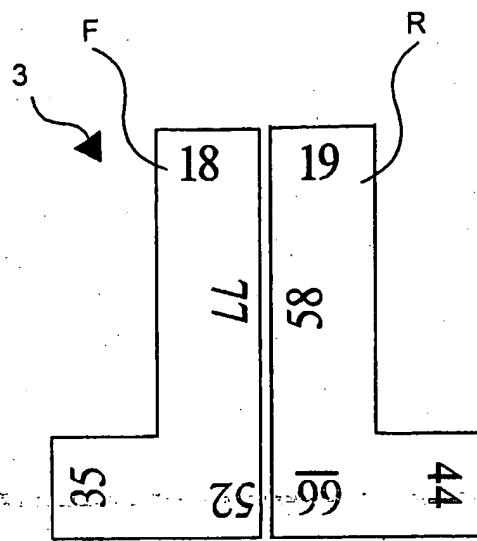


Fig. 6

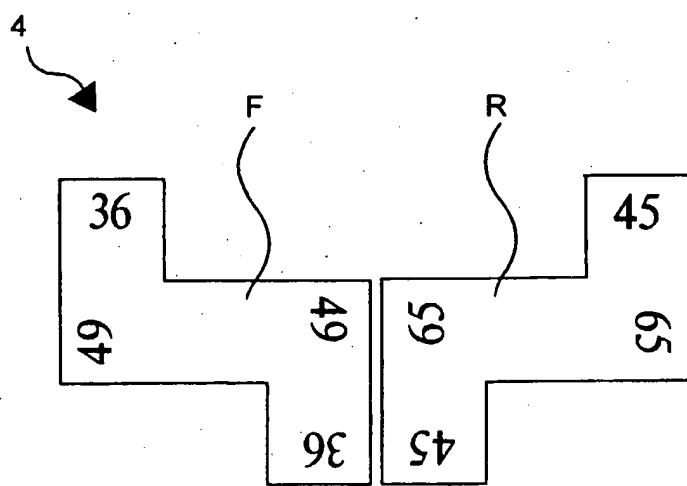


Fig. 7

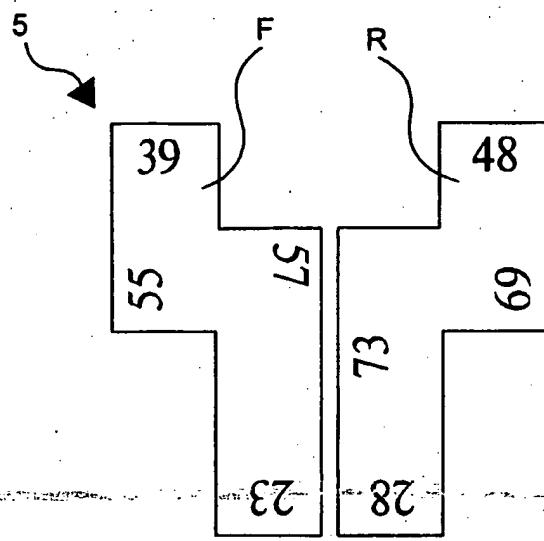


Fig. 8

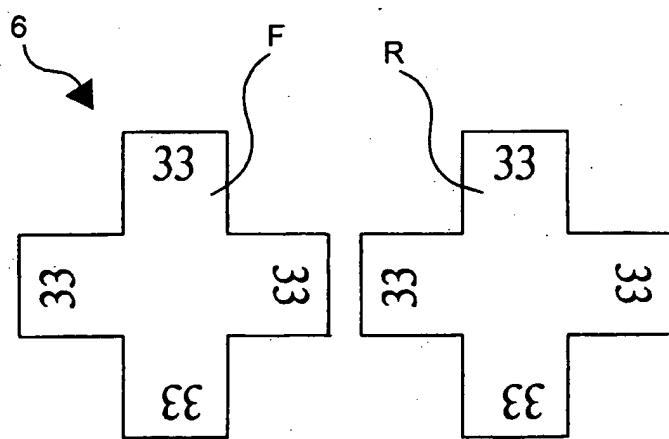


Fig. 9

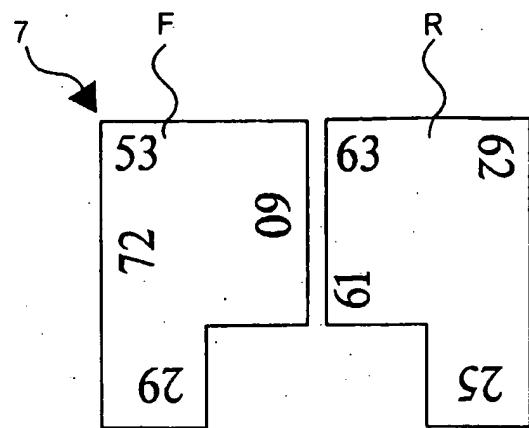


Fig. 10

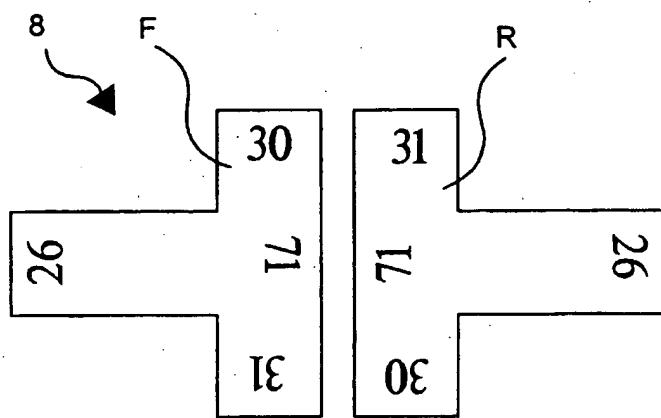


Fig. 11

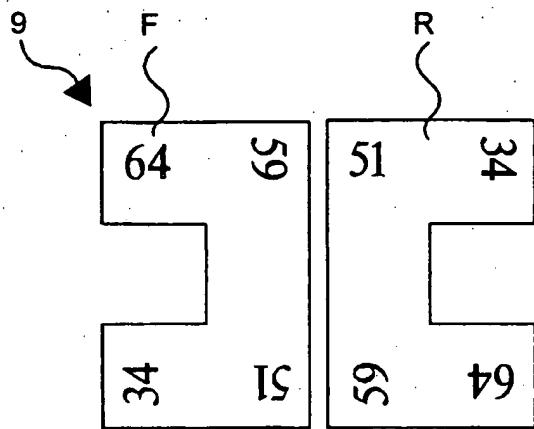


Fig. 12

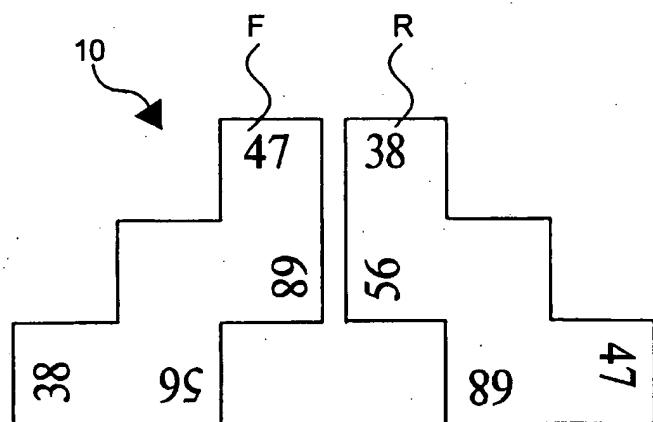


Fig. 13

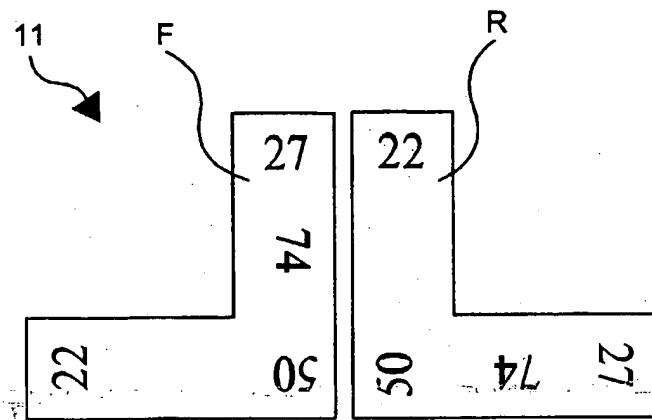


Fig. 14

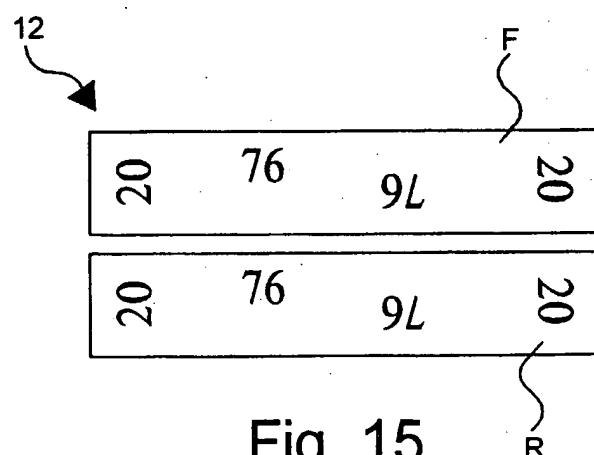


Fig. 15

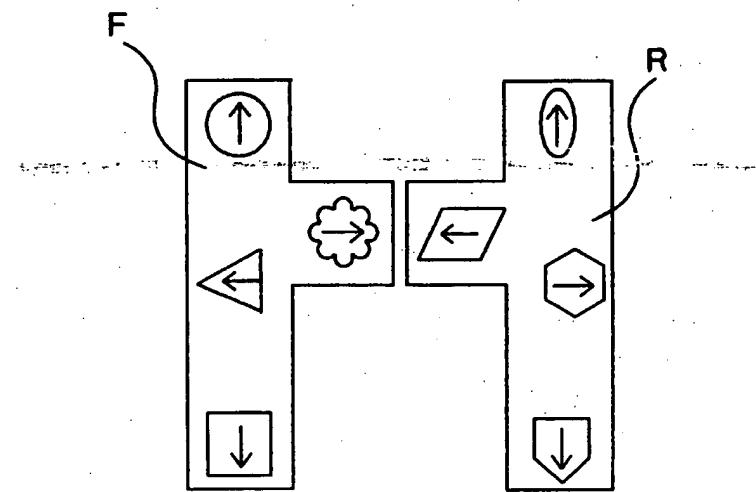


Fig. 16